

Hydrogen Selective Inorganic Membrane

“Next generation” membrane offers improved performance at lower cost

Today, petroleum refining and other industries produce off-gases rich in hydrogen. Because it is neither economical nor feasible to recover this hydrogen using currently available technology (PSA, cryogenics, or polymeric membranes), the hydrogen is simply burned as fuel. However, considerable incentive exists to overcome the technical barriers because hydrogen demand in the petroleum refining industry is expected to increase by 5 to 7% per year as a result of increased regulatory pressure and the use of lower quality higher sulfur crudes. “Next generation” inorganic membranes offered by M&P can be used at intermediate temperatures (100 to 200°C) and demonstrate excellent material stability in the presence of condensable organic vapors (which cripple the performance of polymeric membranes). Further, the flux and recovery efficiency are high, meaning that high-quality hydrogen can be

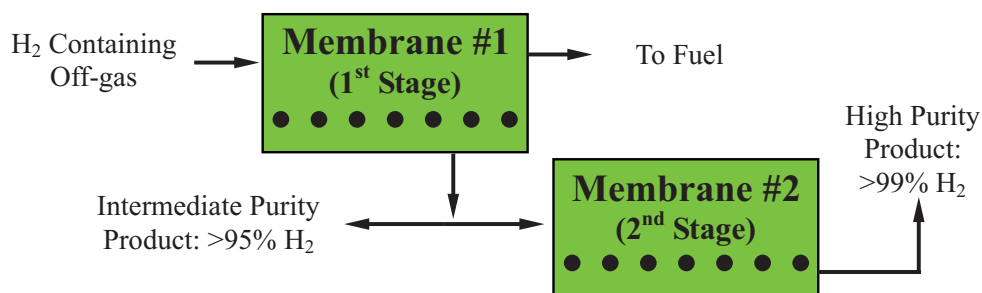
obtained at low cost from refinery off-gases.

Benefits

- Improved hydrogen recovery over other inorganic membranes
- Efficient at lower, more economical operating temperatures (as low as 100°C)
- Lower temperature requirement offers many more hydrogen recovery/separation opportunities than other inorganic membrane technologies

Applications

The worldwide demand for hydrogen is expected to increase, especially as a key feedstock for leading fuel cell technology and in industries such as petroleum refining, where regulatory and economic trends will require more hydrogen. This technology will provide economic justification for recovery/separation processes in industries where hydrogen is currently lost or burned as fuel.



Two-Stage Membrane Process for Hydrogen Recovery

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

Project Summary

The hydrogen selective inorganic membrane developed by Media and Process Technology, Inc. (M&P) represents a “next generation” in membrane materials that can overcome the limitations of polymeric membranes. This membrane consists of an ultra-thin nanoporous inorganic film supported on a low-cost porous ceramic membrane.

In contrast to the common characteristics of inorganic membranes, such as high capital costs and high temperature operation requirements, M&P’s membrane cost is only a fraction of existing commercial ceramic membranes. More importantly, this inorganic-based hydrogen selective membrane can deliver sufficient productivity at temperatures as low as 100°C. As a result, many industrial hydrogen recovery/separation opportunities, which cannot be implemented using existing polymeric membranes due to the aggressive stream environment, can now be justified economically with this new technology.

Project partners have evaluated a full-scale hydrogen selective membrane in a pilot plant for hydrogen recovery from a stream containing equal parts hydrogen and carbon monoxide. Partners are presently preparing a field demonstration scheduled to be in operation by the summer 2003 at the Startech Environmental Corporation facility in Bristol, Connecticut.

Commercialization

Startech is an industrial leader in plasma-based waste conversion technology and is the exclusive licensee for the membrane technology for all applications using plasma systems. The company is actively pursuing the commercialization of hydrogen recovery from its Plasma Converted Gas™ under the trade name “StarCell.”

Project Partners

Media and Process Technology, Inc.
Pittsburg, PA

University of Southern California
Los Angeles, CA

GC Environmental, Inc.
Anaheim, CA

Startech Environmental Corporation
Bristol, Connecticut

For additional information, please contact:

Charles Russomanno
Office of Industrial Technologies
Phone: (202) 586-7543
Fax: (202) 586-1658
E-mail:
charles.russomanno@ee.doe.gov

Paul KT Liu
Media and Process Technology, Inc.
Pittsburg, PA
Phone: (412) 826-3711
E-mail: pliu@mediaandprocess.com

Please send any comments, questions, or suggestions to
webmaster.eren@nrel.gov

*Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585*



**U.S. Department of Energy
Energy Efficiency
and Renewable Energy**

June 2003